

ANNUAL ASSESSMENT REPORT FOR 2009-10
Due October 1, 2010

Department/Program: Mathematics

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Student Learning Outcome (SLO)	For each SLO, list two methodologies and the criteria for successful performance (such as a measurement, rubric or scale that indicates a baseline for competency).				Term Assessed (F07 or S08)
	<i>Methodology 1</i>	<i>Criteria for Success</i>	<i>Methodology 2</i>	<i>Criteria for Success</i>	
1. Demonstrate an understanding of mathematical arguments, and assess their validity.	Portfolios.	We expect 90% to score 2 or higher and 70% to score 3 or higher.	Locally developed examinations.	We expect 70% to score 50 or higher.	F2009
2. Identify the fundamental concepts in main areas of mathematics, including set theory, logic, calculus, discrete mathematics, linear and modern algebra, and real analysis.	Major field tests for seniors.	We expect 80% to perform at or above the satisfactory level. We expect 50% to score at or above the good level.	Locally developed examinations.	We expect 70% to score 50 or higher.	S2008

Student Learning Outcome (SLO)	For each SLO, list two methodologies and the criteria for successful performance (such as a measurement, rubric or scale that indicates a baseline for competency).				Term Assessed (F07 or S08)
	<i>Methodology 1</i>	<i>Criteria for Success</i>	<i>Methodology 2</i>	<i>Criteria for Success</i>	
3. Construct mathematical proofs using standard techniques such as induction, contradiction, and contraposition.	Portfolios.	We expect 90% to score 2 or higher and 70% to score 3 or higher.	Locally developed examinations.	We expect 70% to score 50 or higher.	F2009
4. Solve mathematical problems and perform calculations by applying abstraction and mathematical models as appropriate.	Major field tests for seniors.	We expect 80% to perform at or above the satisfactory level. We expect 50% to score at or above the good level.	Portfolios.	We expect 90% to score 2 or higher and 70% to score 3 or higher.	F2010
5. Communicate mathematical ideas and concepts to various audiences, including being able to use mathematical word processing systems to write mathematics.	Class, conference, and/or poster presentations.	We expect 50% to score 4 or higher. Each major will make one mathematical presentation to the math department faculty/students or other approved audience during the junior/senior year.	Senior Seminar.	We expect 50% to score 4 or higher.	F2010

Student Learning Outcome (SLO)	For each SLO, list two methodologies and the criteria for successful performance (such as a measurement, rubric or scale that indicates a baseline for competency).				Term Assessed (F07 or S08)
	<i>Methodology 1</i>	<i>Criteria for Success</i>	<i>Methodology 2</i>	<i>Criteria for Success</i>	
6. Demonstrate an understanding of various interconnections among the branches of mathematics, the breadth and depth of mathematics, and beauty in mathematics.	Major field tests for seniors.	We expect 80% to perform at or above the satisfactory level. We expect 50% to score at or above the good level.	Senior Seminar.	We expect 90% to score 2 or higher and 70% to score 3 or higher.	S2008

1. **Findings**—*Summarize the findings from the assessment activities for each SLO that was assessed. Identify the SLO # and append supporting documentation such as rubrics, scales, pass rates, test scores, or other measurements used to assess each SLO.*

2007/2008:

SLO #2 and #6, Methodology 1 – 92.9% of the students performed at or above the satisfactory level. This is higher than was expected.

SLO #2, Methodology 2 – 95.2% of the students scored 50 or higher. This is higher than was expected.

SLO #6, Methodology 2 – 97.0% of the response averages was 3 or higher. This is higher than was expected.

2008/2009:

SLO#1 and #3, Methodology 1 – 92.1% of the students scored 2 or higher and 82.0% scored 3 or higher. This is higher than was expected.

SLO#1 and #3, Methodology 2 – 95.3% of the students scored 50 or higher. This was higher than was expected.

2009/2010:

SLO #4, Methodology 1 – 94.4% of the students performed at or above the satisfactory level. This is higher than was expected. 50% of the students performed at or above the good level. This is what was expected. Out of a total of 18 students, one student secured a perfect score and one student received a 91% score.

SLO #4, Methodology 2 – 97.02% of the students scored 2 or higher and 89.29% scored 3 or higher. This is higher than was expected.

SLO #5, Methodology 1 – 88.37% of the students scored 4 or higher. This is higher than was expected.

SLO #5, Methodology 2 – 50% of the students scored 4 or higher. This is what was expected.

2. **Use of Results**—*What programmatic changes, if any, were made in response to the findings? Reference the SLO #.*

The Department now has a prescribed set of carefully chosen Portfolio Problems for SLO #1, #2 and #3. We are also considering the requirement of a senior seminar for our majors, but this requirement has not yet been implemented. When implemented, it will be for SLO #5 and #6.

3. What **support services or resources** for faculty would help your department assess its SLOs better?

4. What **revisions**, if any, to current SLOs did you make or are under consideration?

The wording of SLO#6 has been changed. Methodology 2 “Portfolio” was changed to “Senior Seminar.” For the Major Field Tests (SLO#2, #4 and #6, Methodology 1) the following criterion was added – “We expect 50% to score at or above the good level.” Also the requirement of a senior seminar has been added to SLO#5 to replace “Group Projects”.

5. Map each of your program’s SLOs to the University Learning Outcomes. Make annual updates only if your SLOs changed. For example:

Butler University students will:

1. Explore various ways of knowing in the humanities, social and natural sciences, quantitative and analytic reasoning, and creative arts. (*Know*)
2. Articulate and apply required content knowledge within their area(s) of study. (*Know*)
3. Find, understand, analyze, synthesize, evaluate and use information, employing technology as appropriate. (*Know*)
4. Explore a variety of cultures. (*Know*)
5. Recognize the relationship between the natural world and broader societal issues. (*Know*)
6. Communicate clearly and effectively. (*Do*)
7. Demonstrate collaborative behavior with others. (*Do*)
8. Practice ways and means of physical well-being. (*Do*)
9. Acquire the skills to make informed, rational and ethical choices. (*Do*)
10. Appreciate diverse cultures, ethnicities, religions and sexual orientations. (*Value*)
11. Share their talents with Butler and the greater community at large. (*Value*)
12. Be exposed to the value of lifelong learning. (*Value*)

Mathematics Student Learning Outcomes:	Butler University Learning Outcomes											
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	1	2	3	4	5	6	7	8	9	10	11	12
1. Demonstrate an understanding of mathematical arguments, and assess their validity.	X	X	X			X	X		X			X
2. Identify the fundamental concepts and main areas of mathematics, including set theory, logic, calculus, discrete mathematics, linear and modern algebra, and real analysis.	X	X	X			X						X
3. Construct mathematical proofs using standard techniques such as induction, contradiction, and contraposition.	X	X	X			X			X			
4. Solve mathematical problems and perform calculations by applying abstraction and mathematical models as appropriate.	X	X	X			X	X					
5. Communicate mathematical ideas and concepts to various audiences, including being able to use mathematical word processing systems to write mathematics.	X	X	X		X	X	X				X	X
6. Understand the interconnections among the branches of mathematics, the breadth and depth of mathematics, and beauty in mathematics.	X	X		X	X	X						X

6a. List all courses in the program and map each of your SLOs to the **curriculum** in which the learning occurs, indicating the extent to which the outcome is introduced (I) or refined (R). [Make annual updates only if your SLOs or curriculum changed.]

Course	SLO 1	SLO 2	SLO 3	SLO 4	SLO 5	SLO 6
MA 106		I		I		
MA 107		R		R		
MA 200	I		I	R		
MA 205	I	R	I	R		
MA 206	R	R	R	R		
MA 208		R		R		
MA 215				R	R	
MA 311	R	R	R	R		
MA 312	R	R	R			R
MA 313	R	R	R			R
MA 326	R	R	R	R	R	R
MA 327	R	R	R	R	R	R
MA 330		R		R		R
MA 334				R		R
MA 341		R		R		R
MA 351	R	R	R	R		R
MA 354	R	R	R	R	R	R
MA 360				R		
MA 361				R	R	
MA 362				R		
MA 365		R		R		R

- 6b. **Learning/developmental opportunities for students outside the classroom**—*If any SLO was addressed outside the classroom, explain where and how the learning/developmental opportunities were provided to students in your program? (i.e., internships, field experiences, visiting lectures, collaborative projects, and other creative ideas you may have employed.)*
1. (SLO 5) Students have the opportunity to work as tutors in the math lab, which enhances their ability to communicate mathematics to a wide variety of audiences.
 2. (SLO 5) Students may participate in research projects with faculty members through BSI or USRP. These students typically write up their results using mathematical word processing systems and present their work at conferences such as the Butler URC.
 3. (SLO 6) Students involved in the MAA Chapter or Kappa Mu Epsilon arrange for visiting speakers and also attend talks at regional conferences. This exposure helps students to develop a sense of how the various branches of mathematics are connected and an appreciation for the power and beauty of the subject.

Department/Program: Mathematics
The Rubrics

SLO #1. Understand and assess the validity of a mathematical argument.

Methodology 1: Portfolios

- 5 Gives the correct assessment along with explanations of any flaws, citing laws of logic and rules of inference where appropriate.
- 4 Detects all major flaws but may miss some subtle errors, give incomplete explanations, or claim a minor error that doesn't exist.
- 3 Detects some flaws or recognizes some correct parts of the argument, but misses at least one significant error or claims that important correct steps are flawed.
- 2 Demonstrates understanding of notation and distinguishes between hypotheses and conclusions but cannot assess the validity of the intermediate steps.
- 1 Shows little or no understanding of basic logic or of relevant course material.

SLO #1. Understand and assess the validity of a mathematical argument.

Methodology 2: Locally developed examinations

90—100 Gives the correct assessment along with explanations of any flaws, citing laws of logic and rules of inference where appropriate.

75—89 Detects all major flaws but may miss some subtle errors, give incomplete explanations, or claim a minor error that doesn't exist.

50—74 Detects some flaws or recognizes some correct parts of the argument, but misses at least one significant error or claims that important correct steps are flawed.

30—49 Demonstrates understanding of notation and distinguishes between hypotheses and conclusions but cannot assess the validity of the intermediate steps.

0—29 Shows little or no understanding of basic logic or of relevant course material.

SLO #2. Identify fundamental mathematical concepts.

Methodology 1: Major Field Tests for seniors

The scale range for the total score for this examination is 120-200.

180 – 200	Excellent
165 – 179	Very good
150 – 164	Good
135 – 149	Satisfactory
120 – 134	Unsatisfactory

SLO #2. Identify fundamental mathematical concepts.

Methodology 2: Locally developed examinations

90 – 100	Able to define terms, state theorems, and place them in the appropriate context. Can distinguish between related concepts and give examples or counter-examples.
75 – 89	States and applies most definitions and theorems correctly but with occasional minor errors.
50 – 74	States and applies some definitions and theorems correctly but with some significant errors or omissions.
30 – 49	Shows some familiarity with the definitions and theorems but little ability to distinguish one concept from another or to apply results correctly.
0 – 29	Cannot distinguish between different mathematical structures.

SLO #3. Construct mathematical proofs.

Methodology 1: Portfolios

- 5 Correct and clear.
- 4 Proof is essentially correct but may contain superficial errors such as missing quantifiers or connectives, undefined variables, misuse of terminology/notation, or minor computational errors.
- 3 Correct beginning and an indication that key issues are recognized but also some significant errors or omissions.
- 2 Shows some acquaintance with the material and attempts to use relevant results but no significant progress toward a proof.
- 1 Proof does not make sense, is completely unreadable, or contains a serious error that trivializes the problem.

SLO #3. Construct mathematical proofs.

Methodology 2: Locally developed examinations

90 – 100	Correct and clear.
75 – 89	Proof is essentially correct but may contain superficial errors such as missing quantifiers or connectives, undefined variables, misuse of terminology/notation, or minor computational errors.
50 – 74	Correct beginning and an indication that key issues are recognized but also some significant errors or omissions.
30 – 49	Shows some acquaintance with the material and attempts to use relevant results but no significant progress toward a proof.
0 – 29	Proof does not make sense, is completely unreadable, or contains a serious error that trivializes the problem.

SLO #4. Solve mathematical problems and perform calculations.

Methodology 1: Major Field Tests for seniors

The scale range for the total score for this examination is 120-200.

180 – 200	Excellent
165 – 179	Very good
150 – 164	Good
135 – 149	Satisfactory
120 – 134	Unsatisfactory

SLO #4. Solve mathematical problems and perform calculations.

Methodology 2: Portfolios

- 5 Correct and clear.
- 4 Essentially correct but with some minor numerical errors or notational issues.
- 3 Solution uses correct method but contains several errors or at least one significant error.
- 2 Shows some familiarity with the material but also major deficiencies and inability to perform essential operations.
- 1 Solution contains one or more serious conceptual errors or an error that trivializes the problem.

SLO #5. Communicate mathematical ideas and concepts to various audiences, including being able to use mathematical word processing systems to write mathematics.

Methodology 1: Class, conference and/or poster presentations.

- 5 Presents clear and correct mathematics at a level appropriate for the audience. All slides are typeset using LateX or MSWord equation editor.
- 4 Presentation contains no major deficiencies and shows comprehension of the mathematics involved.
- 3 Presentation contains a major deficiency or several minor deficiencies.
- 2 Presentation contains major deficiencies.
- 1 Presentation is unclear or at an inappropriate level for the audience.

SLO #5. Communicate mathematical ideas and concepts to various audiences, including being able to use mathematical word processing systems to write mathematics.

Methodology 2: Senior Seminar

- 5 Presents clear and correct mathematics at a level appropriate for the audience. All slides are typeset using Latex or MSWord equation editor.
- 4 Presentation contains no major deficiencies and shows comprehension of the mathematics involved.
- 3 Presentation contains a major deficiency or several minor deficiencies.
- 2 Presentation contains major deficiencies.
- 1 Presentation is unclear or at an inappropriate level for the audience.

SLO #6. Demonstrate an understanding of various interconnections among the branches of mathematics, the breadth and depth of mathematics, and beauty in mathematics.

Methodology 1: Major Field Tests for seniors

The scale range for the total score for this examination is 120-200.

180 – 200	Excellent
165 – 179	Very good
150 – 164	Good
135 – 149	Satisfactory
120 – 134	Unsatisfactory

SLO#6. Demonstrate an understanding of various interconnections among the branches of mathematics, the breadth and depth of mathematics, and beauty in mathematics.

Methodology 2: Senior Seminar

- 5 Presents clear and correct mathematics at a level appropriate for the audience. All slides are typeset using Latex or MSWord equation editor.
- 4 Presentation contains no major deficiencies and shows comprehension of the mathematics involved.
- 3 Presentation contains a major deficiency or several minor deficiencies.
- 2 Presentation contains major deficiencies.
- 1 Presentation is unclear or at an inappropriate level for the audience.